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ABSTRACT

The performance of 18 deaf college students who learned English words and their definitions using the mnemonic keyword method with pictorial elaboration was compared with the performance of 13 controls who learned the same words and their definitions using their own strategies. Immediate and delayed prompted word-definition recall and delayed word-recognition measures were used to compare the performance of the two groups. Results indicated that subjects' immediate recall of word-definitions was better than delayed recall. A significant facilitative effect of the keyword method was found for word-definition recall. It is concluded that the mnemonic method is a useful classroom technique to introduce new English vocabulary to deaf students. (17 references) (JDD)

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The effectiveness of the keyword method for vocabulary learning in deaf young adults

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THE KEYWORD METHOD AND DEAF LEARNERS

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Abstract

The performance of deaf college students who learned English words and their definitions using the mnemonic keyword method with pictorial elaboration was compared with the performance of their controls who learned the same words and their definitions using their own strategies. Immediate and delayed prompted word-definition recall and delayed word-recognition measures were used to compare the performance of the two groups. A facilitatory effect of the keyword method was found in deaf students for the word-definition recall suggesting that this mnemonic method is a useful classroom technique to introduce new English vocabulary to deaf students.

The mnemonic keyword method (Atkinson, 1975) has been shown to be effective for learning new English vocabulary or foreign language vocabulary in English-speaking children and young adults with normal hearing (see Levin, 1981; Pressley, Levin, & Delaney, 1982; for reviews). The keyword method consists of a two-stage learning process. In the first stage, the student learns a keyword which is a highly familiar English word that shares some phonemic similarity with a target word to be learned. In the second stage, the learner constructs a meaningful link involving the keyword and the definition of the target word. This is done by using verbal elaboration, visual imagery, or a pictorial illustration that includes the keyword and the target word. The use of a pictorial illustration that includes the keyword and the target word has been found to be the most effective method for learning new English or foreign language vocabulary by normal-hearing English-speaking children compared both to other variations of the keyword method and to other non-keyword methods (Levin, 1981; Levin, McCormick, Miller, Berry, & Pressley, 1982).

This study was undertaken to investigate whether the keyword method facilitates English vocabulary learning in deaf college students. It is well known that one factor that contributes to poor reading skill in deaf people is their limited knowledge of vocabulary. It has been estimated that an average deaf young adult's knowledge of vocabulary is at about the fourth grade level (Di Francesca, 1972). Even those who successfully pursue college-level education continue to have limited English vocabulary knowledge and reading skills compared to their hearing counterparts. This fact has long been recognized by institutions of higher education for deaf people which offer extensive training in English after admission. In the context of this educational history and practice, the mnemonic keyword method, if found effective, would be a valuable aid for vocabulary training of many deaf people throughout the course of their formal education.

The version of the keyword method (see Levin, 1981) chosen for this study uses a pictorial illustration that provides a situational context in which a target word and a keyword are used by two cartoon characters in conversing with each other (see Figure 1). Students were instructed to use the keyword and the illustration to remember the target word and its definition.

Insert Figure 1 about here

This particular version of the keyword method which involves pictorial illustrations was used for the following reasons: 1. Available evidence indicates that this method is the most effective compared to other keyword methods. 2. The keyword method is known to work better when the non-verbal system is engaged by experimenter-provided pictures rather than self-generated images to associate with the target words (see Pressley et al., 1982). Experimenter-provided pictures give all students the same explicit non-verbal input, thus eliminating variance due to possible individual differences in the ablity to use covert imagery.

Learning by association is a long standing technique used in education. The keyword method involving pictorial illustrations encourages the learner to build on an already existing knowledge by forming new associations with an old, highly familiar word presented within a rich situational context. This particular method also utilizes the non-verbal memory system in addition to the semantic memory system. Such dual coding has been shown to facilitate learning and retention of verbal information (see Paivio, 1979). Finally, this technique appears easy for teachers to use in classroom situations.

In the present study, we chose to test students' performance in a classroom setting because we were primarily interested in the eventual use of the mnemonic keyword method as a teaching

aid. In general, a facilitatory effect of the keyword method has been found mostly in studies that involve individual rather than group administration. With the exception of few studies with children (Levin, Pressley, McCormick, Miller, & Shriberg, 1979; Merry, 1980), and with college students (Roberts & Kelly, 1985), the facilitatory effect of the keyword method has failed to materialize when words are learned in a small group or classroom situations. However, as Pressley et al. (1982), and Levin et al. (1979), have pointed out, several methodological and statistical issues can be raised regarding previous classroom studies that failed to find a facilitatory effect. Therefore, previous mixed results do not preclude a possibly effective application of the keyword method in the classroom.

Method

Subjects.

Thirty one profoundly deaf college students at NTID, ranging in age from 19-25 years, participated in this experiment. The average hearing loss measured by the pure tone average in the better ear at 500-1000-2000 Hz (ISO, 1975) was 96.9 dB HL (sd= 12.8 dB HL). The mean score of the subjects on the California Reading Comprehension Test (Tiegs & Clark, 1963) was 8.0 (sd= 1.1). The students were enrolled in two different sections of an NTID course for vocabulary development who volunteered for the experiment. They were paid for their participation.

Stimuli.

Ten words were selected from a pool of 100 words that the students from a previous class in the same course had checked on a questionnaire as unknown to them. The words ranged from 4 syllables in length. The word frequency ranks (Carroll, Davies, & Richman, 1971) using the rank list for U value of the word which is its estimated frequency-per-million ranged from 6000-27400.

Ten additional words were selected to serve as keywords, all of which matched the first two letters of the target words they were paired with. This manipulation was done to ensure some shared orthographic and phonemic similarity between the keyword and the target word. All of the keywords were high frequency words with ranks ranging from 300-5800 (Carroll et al., 1971), and were checked on the questionnaire as known by the previous class.

Word-definitions for target words were written by consulting the Webster New Collegiate Dictionary and the Longman Dictionary of Contemporary English and the vocabulary of these definitions was judged as being within the vocabulary knowledge of the students by an English instructor (see Table 1, for the target words, keywords, word-definitions, and word frequency ranks).

Insert Table 1 about here

Pictorial illustrations for the target words in the keyword condition were drawn by a professional illustrator. The target word with its keyword in parantheses and its definition appeared below each of the picture. The target words and the keywords were typed in upper case while the word-definitions were typed using upper and lower case. Only the target word (in upper case) and its definition (in upper and lower case) was typed on a blank paper for each of the target words in the control condition. The stimuli in the keyword condition and the control condition were reproduced on overhead transparancies.

For each of the target words a distractor word similar in syllable length and in the word frequency rank (Carroll et al. , 1971) was selected. The target words and distractor words were rated as not known, and all the keywords were rated as known to students by their instructors. These words, randomly ordered, comprised the written word-recognition test and

are reported in Table 2.

Insert Table 2 about here

Procedure.

The data were collected over two quarters. In each quarter, all students in the two sections of the vocabulary training course were given a long list of words which included the target words and keywords and were asked to check the words they knew. Since our subject pool was drawn from these two classes, we had each student's prior knowledge rating available for each word used in the experiment. Students were not told about the experiment when they judged the words, but did the task as a classroom assignment.

A week or more later, volunteers were tested in two separate group sessions, followed by another set of testing sessions a week later. One group received the control condition, while the other received the keyword condition. In both groups subjects were first given instructions and practice in learning word-definitions of two target words (different from those in the target words list) using either the keyword method or their own strategies before the experiment began. These two words and the keywords associated with them were rated as known to their students by the instructors. Sign and speech were used to supplement written instructions to subjects. Each item in the ten target words list was presented visually for one minute using an overhead projector. At the end of the session, after a two minute pause, the subjects were given a prompted written word-definition recall test in which all the ten randomly-ordered words were typed on paper and subjects wrote their definitions in the spaces provided. Five minutes were allowed for the test. A week later, subjects were given the written word-recognition test, followed by the written word-definition test. In the written word-recognition test, subjects

checked each word to indicate if it had been shown or not.

Results

The data collected during the two quarters were pooled. There were eighteen subjects in the keyword group and 13 in the control group. Separate two tailed *t*-tests carried out to compare the group scores on age, average hearing loss, and reading skill did not achieve or approach significance ($t<1$), suggesting that the groups were not different from each other on these measures.

The analysis of the prior-knowledge rating data showed that on the average the subjects knew 21.3% of the target words and 20.3% of the distractor words used in this study. This difference was not significant ($F<1$). The two groups did not differ on their prior-knowledge rating of target words ($E(1,29)= 2.5$, $p>.10$). However, the groups differed on their prior-knowledge rating of distractor words ($E(1,29)= 4.3$, $p<.05$) with the conrol group knowing more words (28.5%) than the keyword group (14.4%). Although this difference may confound interpretation of the word-recognition test, the word-definition recall data are not affected by it.

The written word-definition tests were scored for accuracy of core meaning. The written word-recognition test which asked the subjects to check if they were shown the item was a yes-no response test. Therefore, the data were scored for both the hit rate and the false alarm rate to derive a *d'* score for each subjet using the formula:

$$d' = z(FA) - z(H)$$

where $z(FA)$ is the standard score corresponding to the given false alarm rate and $z(H)$ is the standard score corresponding to the given hit rate (see Murdock, 1982). If a subject had a 100% hit rate or a zero false alarm rate, the z value of 5.33 or -5.33 was assigned to derive a *d'* score for that subject.

A two-tailed *t*-test comparing the two groups on *d'* scores of their subjects showed that the groups were not significantly different from each other in word-recognition performance (t= 1.2, df= 29, $p > .10$). It can be argued that the artificial assignment of *z* scores to perfect hit rates and zero false alarm rates may have confounded the *d'* data. Therefore, those adjusted scores were eliminated from the group data and another two-tailed *t*-test was coducted. The results were again non-significant ($t < 1$, df=13). Although the effect of asymmetrical knowledge of distractor words on the word-recognition test performance can not be precisely partialed out, these comparisons show that, at least, no gross differences exist in the recognition performance of the two groups.

Group X Time of Testing analyses of variance were conducted on the percent correct word-definitions. Group was a between-subjects factor and Time of Testing was a within-subjects factor. The means associated with these analyses are reported in Table 3. There was a significant main effect for Group ($F(1, 29)=8.13$, $p < .01$), with the keyword group recalling more word-definitions than the control group. There was also a significant main effect for Time of Testing ($F(1, 29)= 57.42$, $p < .001$), with immediate test performance for word-definition recall being better than delayed test performance. There were no significant interactions.

Insert Table 3 about here

Discussion and Conclusion

The results of this study showed that subjects' immediate recall of word-definitions was better than delayed recall, as expected. More important, they showed a significant facilitatory effect on both immediate and delayed recall performance of the keyword group compared to the control group. These results suggest that the keyword method is effective for the acquisition of

word-definitions by deaf students, and that its effectiveness seems to extend to long-term retention unlike the situation with hearing students (McDaniel, Pressley, & Dunay, 1987).

The deaf students in this study were re-tested a week later, after having learned the target words in a single-trial learning task in a group setting in which exposure to each target word was fixed for all students. Although the immediate word-definition recall test gave them an opportunity to see all the target words again, the students saw the word-definitions only once. Given the above mentioned constraints on the learning situation, it is impressive that the keyword method continued to facilitate the deaf students' performance after a week. These data suggest that the keyword method may prove to be particularly effective for learning and retention of word-definitions in deaf students.

The results of the recognition analysis showed that recognition of target words was not facilitated by the use of the keyword method. The absence of the facilitatory effect in the delayed recognition data is not very meaningful in evaluating the effectiveness of the keyword method for deaf students. McDaniel & Tillman (1987) have noted that the facilitatory effect on learning word-definitions may not necessarily occur in retention of the words themselves. Thus, a delayed word-recognition test is not a crucial test for evaluating the effectiveness of the keyword method.

Although it cannot be definitely concluded from this study whether profoundly deaf students create phonological links between the target words and the keywords, the results of this study suggest that limitations on the adequacy of phonological coding processes due to deafness do not necessarily impede successful use of the keyword method. Establishing a phonological link between the target word and the keyword is considered essential for the keyword method's effectiveness with hearing people. Whether such link is necessary and whether it is established for the successful use of the keyword method by deaf students needs to

be determined by further research.

It is possible that some phonological coding processes were, in fact, used by the deaf students since recent research shows that profoundly deaf people may use a phonological code in processing written English (Hanson & Fowler,1987; Parasnis, 1983). Perhaps, these processes were sufficient to establish an effective link between the target word and the keyword. An alternative hypothesis is that only the orthographic information was used and was sufficient to establish an effective link between the keyword and the target word. Lastly, it can be hypothesised that the other components of this method namely using a known word to link with the unfamiliar word, using a rich situational context, and using pictorial elaboration, were powerful enough to make this mnemonic strategy effective for deaf students despite a lack of an effective phonological and/or orthographic link between the target word and the keyword.

Studies that systematically vary the orthographic and phonological similarities of target words and keywords will be able to determine whether phonological coding processes occur when deaf students use this mnemonic strategy. They can also address the question of how critical it is to establish a phonological link between the target word and the keyword for this mnemonic strategy to be successful. Furthermore, studies that use different versions of the keyword method with deaf students can be conducted to separate the effects of the different components of the keyword method.

In conclusion, the results of this study suggest that the keyword method using pictorial elaboration is a promising classroom technique for English vocabulary learning by deaf young adults. This particular mnemonic method may be introduced immediately in the classroom to improve vocabulary learning of deaf students. Nevertheless, we need more studies to clarify how the keyword method in general is used by deaf students so that this mnemonic technique can be optimally utilized in vocabulary learning tasks.

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Table 1.

Target words and their definitions. The keywords are reported in parantheses.

Apparatus (apple): An appliance or machine designed to do a specific thing.

Culprit (cup): A person accused of doing something wrong.

Fragment (frog): A part broken off of a larger object.

Fumes (fun): Smoke, vapor, or gas.

Inscription (ink): Writing on the surface of something hard, like stone or metal.

Novice (noise): A new and inexperienced beginner.

Obstacle (obey): Something that stands in the way and prevents movement.

Refuge (rent): A place that gives protection from danger.

Remedy (rest): A medicine or treatment to cure a disease or problem.

Truce (truck): An agreement to stop fighting.

Note. The pictorial illustrations used in the keyword condition are available on request.

Table 2.

Target words and their distractors paired on word frequency ranks.

The target words	Freq rank	Distractor words	Freq rank
Apparatus	6000	Velocity	5900
Culprit	18300	Monsoon	18300
Fragment	11600	Stimulus	11300
Fumes	9200	Foe	8900
Inscription	16700	Pension	16700
Novice	27400	Courier	27400
Obstacle	13500	Ambush	14400
Refuge	7000	Pursuit	7000
Remedy	11300	Meteor	11300
Truce	19800	Cue	18500

Note. The word frequency ranks are reported from Carroll et al. (1971), and indicate the rank order of the U value of that word which is its estimated frequency-per-million.

Table 3.

Recall performance of deaf students.

	Mean % correct		
	Word-definition recall		
Group	Immediate	Delayed	Total
Keyword	68.3	35.6	51.9
Control	43.1	21.5	32.3*
Total	57.7	29.7*	

* $p < .01$ for the mean percent score differnces between immediate and delayed word-definition recall, and between the keyword and control group performance.

Figure caption

Figure 1. Examples of the items in the keyword condition.

Figure 1. Examples of the Items in the keyword condition

CULPRIT: (CUP)
A person accused of doing something wrong.

REMEDY: (REST)
A medicine or treatment to cure a disease or problem.